

2-6 Algebraic Proof

Properties of Equality

Addition Property--If $a = b$ and $c = d$, then $a + c = b + d$.

Subtraction Property--If $a = b$ and $c = d$, then $a - c = b - d$.

Multiplication Property--If $a = b$, then $c \cdot a = c \cdot b$.

Division Property-- If $a = b$ and $c \neq 0$, then $\frac{a}{c} = \frac{b}{c}$

Distributive Property-- $a(b + c) = ab + ac$

Substitution Property--If $a = b$, then either a or b may be substituted for the other in any equation.

(Combining like terms)

Reflexive Property-- $a = a$

Symmetric Property--If $a = b$, then $b = a$.

Transitive Property--If $a = b$ and $b = c$, then $a = c$.

Reflexive, symmetric, and transitive also work with congruence.

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Example 1

1. $8(x - 5) = 32$

2. $8x - 40 = 32$

3. $8x - 40 + 40 = 32 + 40$

4. $8x = 72$

5. $\frac{8x}{8} = \frac{72}{8}$

6. $x = 9$

1. Given
2. Distribute
3. Addition
4. Substitution
5. Division
6. Substitution

Example 1

1. $8(x - 5) = 32$

2. $8x - 40 = 32$

3. $8x = 72$

4. $x = 9$

1. Given
2. Distr.
3. Addition
4. Division

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Example 2

1. $5x - 3 = 12$

2. $5x = 15$

3. $x = 3$

1. Given
2. Addition
3. Division

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Example 3

1. $8x + 3x - 9 = 24$

2. $11x - 9 = 24$

3. $11x = 33$

4. $x = 3$

1. Given
2. Substitution
3. Add.
4. Div.

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Example 4

1. $2(5 - 3x) - 4(x + 7) = 92$

2. $10 - 6x - 4x - 28 = 92$

3. $-10x - 18 = 92$

4. $-10x = 110$

5. $x = -11$

6. $-11 = x$

1. Given
2. Distr.
3. Subst.
4. Add
5. Div
6. Symm.

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Justify each statement.

1. Ref. $m\angle 1 = m\angle 1$
2. Add. If $m\angle 1 = m\angle 2$, then $m\angle 1 + m\angle 3 = m\angle 2 + m\angle 3$
3. Mult. If $AB = CD$, then $2 \cdot AB = 2 \cdot CD$.
4. Symm. If $RS = XY$, then $XY = RS$
5. Transitive If $m\angle A = m\angle B$, and $m\angle B = m\angle C$, then $m\angle A = m\angle C$
6. Division If $2 \cdot m\angle 1 = 90$, then $m\angle 1 = 45$
7. Subst If $m\angle 9 + m\angle 10 = 150^\circ$, and the $m\angle 10 = 48^\circ$, then $m\angle 9 + 48 = 150$.
8. Subtr. If $m\angle 9 + 48 = 150$, then $m\angle 9 = 102$.

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State the property that justifies each statement.

- 4. If $2x = 5$, then $x = \frac{5}{2}$
- 5. If $\frac{x}{2} = 7$, then $x = 14$.
- 6. If $x = 5$ and $b = 5$, then $x = b$.
- 7. If $XY - AB = WZ - AB$, then $XY = WZ$.
- 8. Solve $\frac{x}{2} + 4x - 7 = 11$. List the property that justifies each step.
- 9. Complete the following proof.
Given: $5 - \frac{2}{3}x = 1$
Prove: $x = 6$

Statements	Reasons
a. $\frac{?}{?}$	a. Given
b. $3(5 - \frac{2}{3}x) = 3(1)$	b. $\frac{?}{?}$ Mult.
c. $15 - 2x = 3$	c. $\frac{?}{?}$ Distr.
d. $\frac{?}{?}$	d. Subtraction Prop.
e. $x = 6$	e. $\frac{?}{?}$ DIV

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